



5G Numerology



Numerology?

| | | |
|---------|----|----|
| 6 | 7 | 2 |
| 1 | 5 | 9 |
| 8 | 3 | 4 |
| Sun | | |
| 7 | 8 | 3 |
| 2 | 6 | 10 |
| 9 | 4 | 5 |
| Moon | | |
| 8 | 9 | 4 |
| 3 | 7 | 11 |
| 10 | 5 | 6 |
| Mars | | |
| 9 | 10 | 5 |
| 4 | 8 | 12 |
| 11 | 6 | 18 |
| Mercury | | |
| 10 | 11 | 6 |
| 5 | 9 | 13 |
| 12 | 7 | 9 |
| Jupiter | | |
| 11 | 12 | 7 |
| 6 | 10 | 14 |
| 13 | 8 | 9 |
| Venus | | |
| 12 | 13 | 8 |
| 7 | 11 | 15 |
| 14 | 9 | 10 |
| Saturn | | |
| 13 | 14 | 9 |
| 8 | 12 | 16 |
| 15 | 10 | 11 |
| Rahu | | |
| 14 | 15 | 10 |
| 9 | 13 | 17 |
| 16 | 11 | 12 |
| Ketu | | |

| | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 |
| A | B | C | D | E | F | G | H | I |
| J | K | L | M | N | O | P | Q | R |
| S | T | U | V | W | X | Y | Z | |

Modern-day numerology charts are based upon the Pythagorean system.

AstrologyBay.com

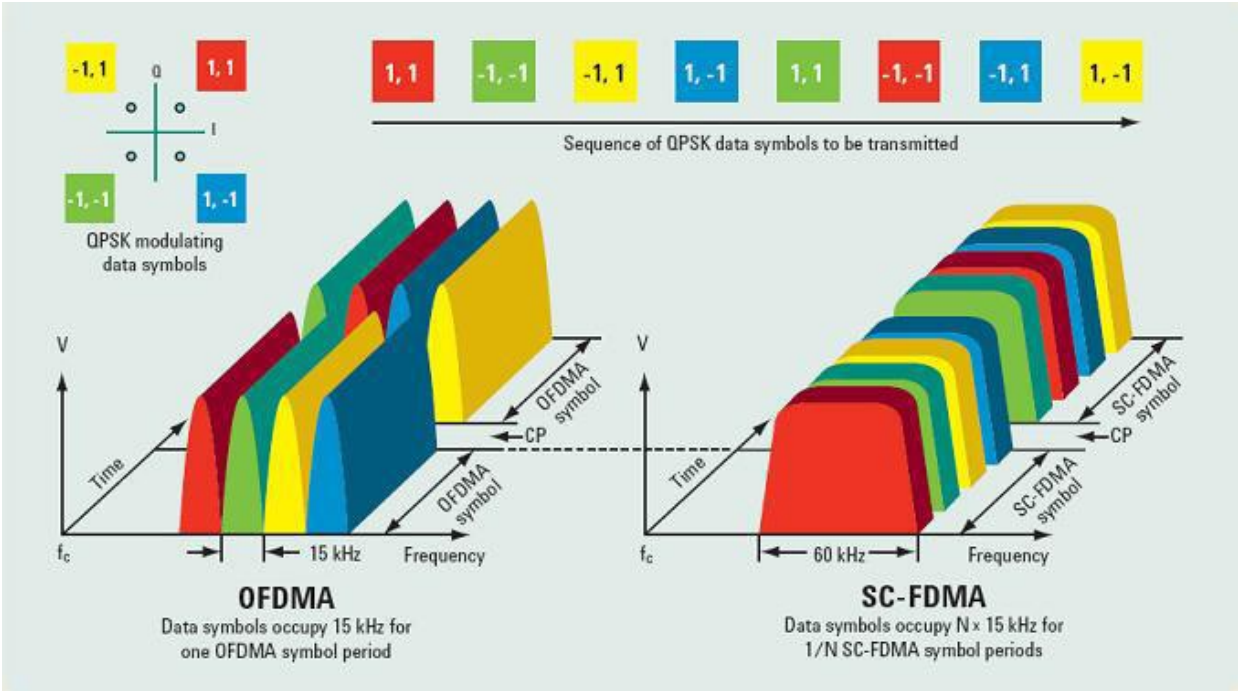
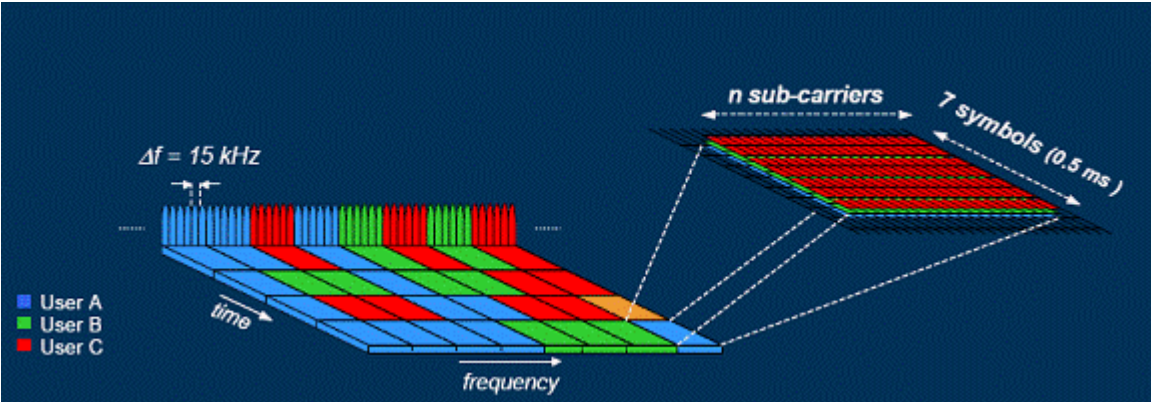
**Is It 2 Good
2 Be True?**
Find out with a Numerology
Compatibility report

FREE START MY REPORT

www.horoscopeyearly.com

Numerology is any belief in the divine, mystical relationship between a number and one or more coinciding events. It is also the study of the numerical value of the letters in words, names and ideas. It is often associated with the paranormal, alongside astrology and similar divinatory arts. – [Wikipedia](https://en.wikipedia.org/wiki/Numerology)

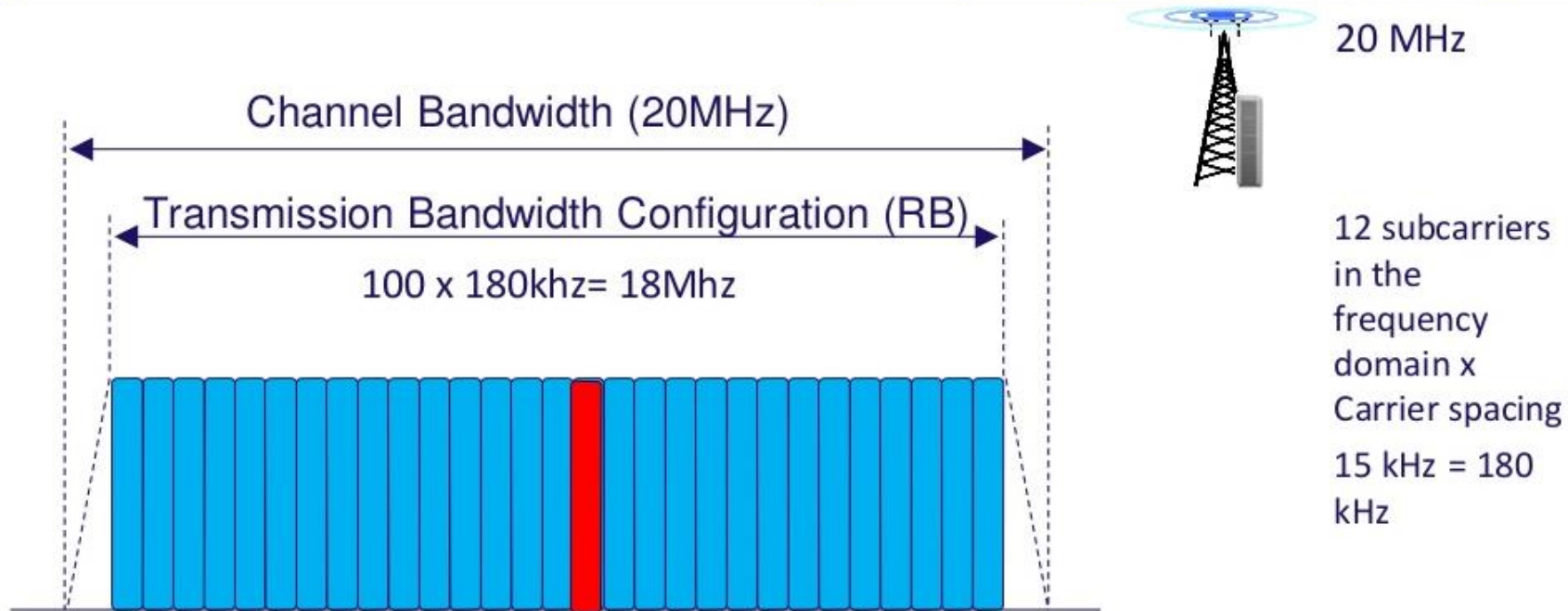
OFDMA Transmission Scheme in LTE



Source

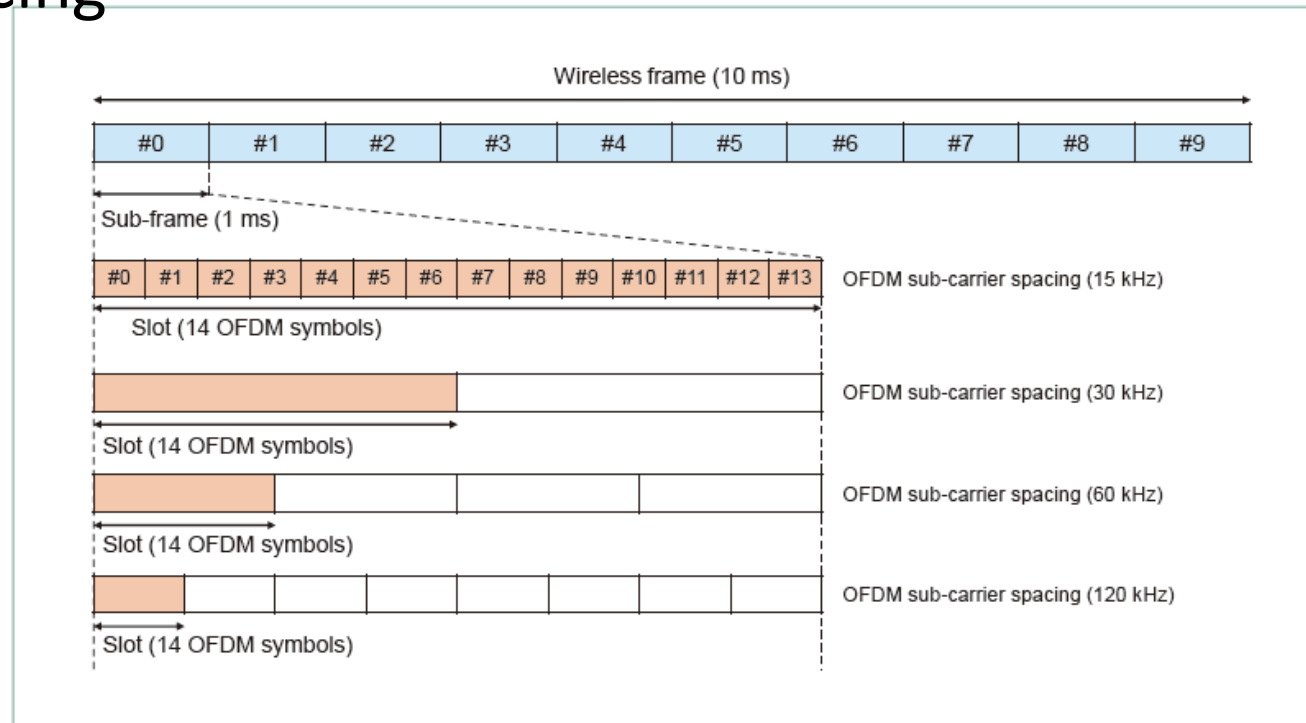
LTE Channel Bandwidth

| | | | | | | |
|-------------------------------------|------|-----|-----|-----|------|------|
| Channel Bandwidth (MHz) | 1.4 | 3 | 5 | 10 | 15 | 20 |
| Transmission Bandwidth Config. (RB) | 6 | 15 | 25 | 50 | 75 | 100 |
| Number of Subcarriers | 72 | 180 | 300 | 600 | 900 | 1200 |
| Occupied Bandwidth (MHz) | 1.08 | 2.7 | 4.5 | 9.0 | 13.5 | 18.0 |



5G NR (New Radio) Radio Frame

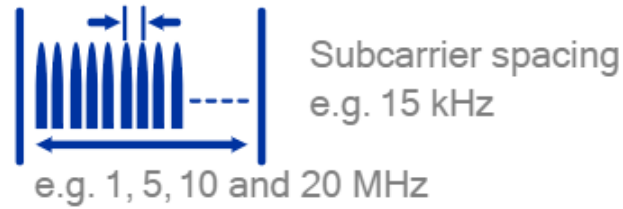
- The 5G NR Radio Frame is in units of 10ms
- Subframes are defined in units of 1ms
- Slots are defined as 14 OFDM Symbols and their time interval depends on sub-carrier spacing



Source: NTT Docomo

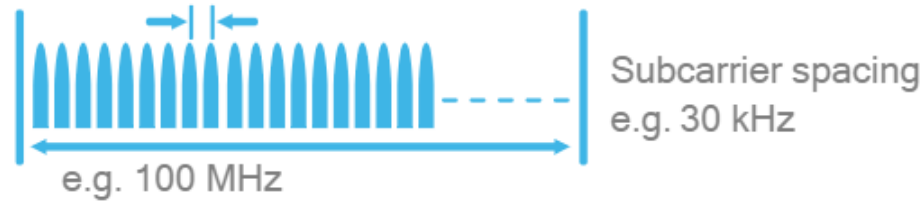
Scalable OFDM numerology to efficiently address diverse spectrum, deployments, and services

Outdoor macro coverage
e.g., FDD 700 MHz



2ⁿ scaling of subcarrier spacing

Outdoor macro and small cell
e.g., TDD 3-5 GHz



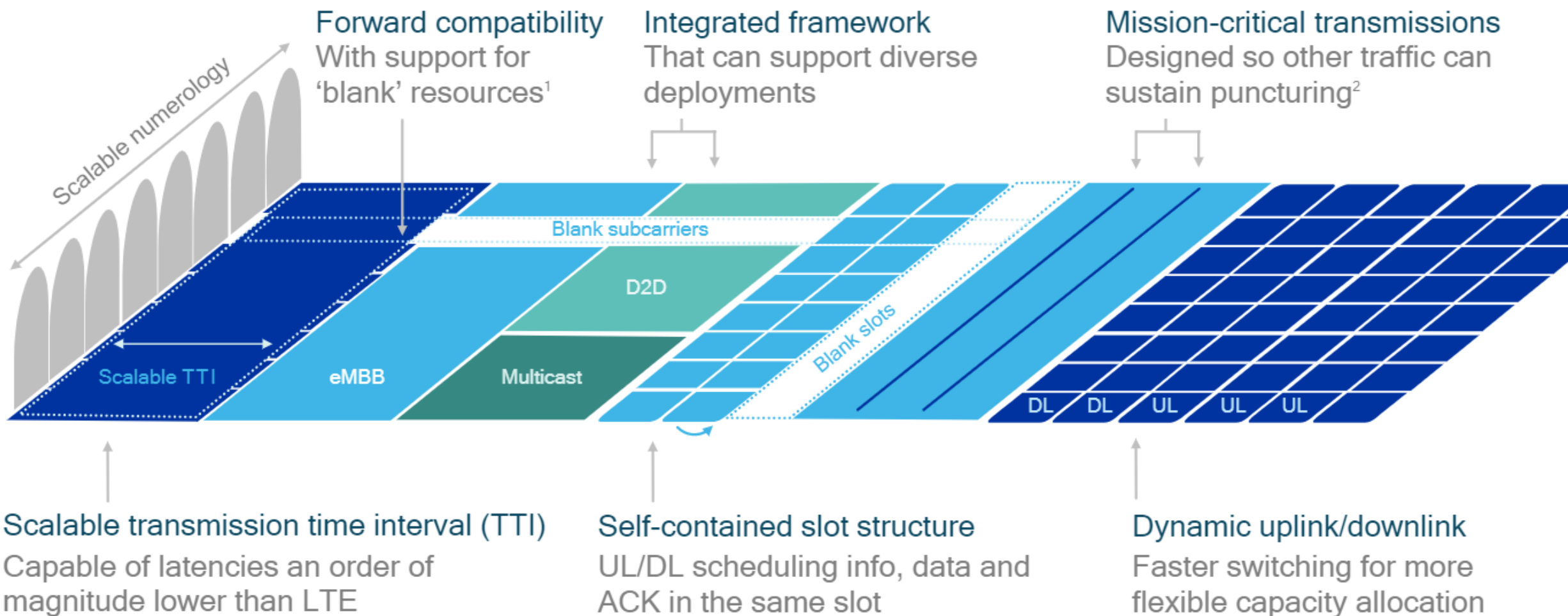
Indoor wideband
e.g., unlicensed 6 GHz



mmWave
e.g., TDD 28 GHz



Flexible, forward compatible framework efficiently multiplexes envisioned and future 5G services

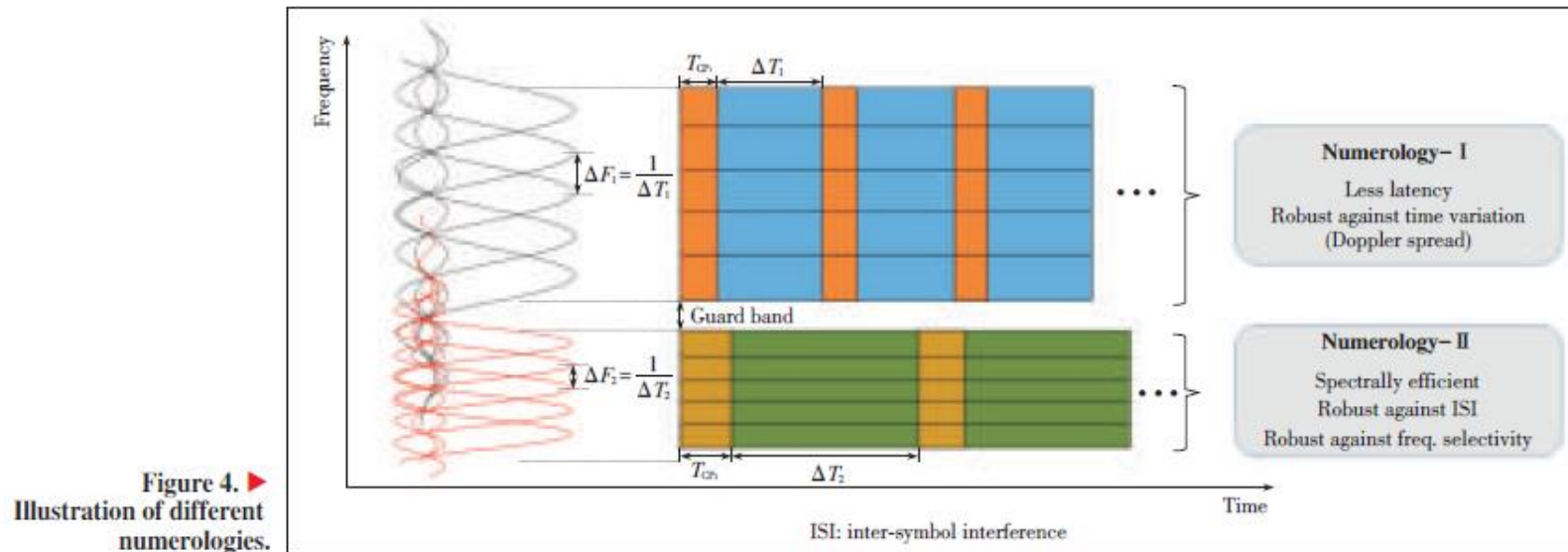


1. Blank resources may still be utilized, but are designed in a way to not limit future feature introductions

2. Nominal 5G access to be designed such that it is capable to sustain puncturing from mission-critical transmission or bursty interference

5G Numerology?

In the context of 3GPP 5G standardization contributions, the term numerology refers to the configuration of waveform parameters, and different numerologies are considered as OFDM-based sub-frames having different parameters such as subcarrier spacing/symbol time, CP size, etc.



Source: [ZTE](#)

Subcarrier Spacing

- The NR subcarrier spacing is defined as 15×2^n kHz, where n can take positive values at the moment
 - $n = 0, 15 \times 2^0 = 15$ kHz
 - $n = 1, 15 \times 2^1 = 30$ kHz
 - $n = 2, 15 \times 2^2 = 60$ kHz
 - $n = 3, 15 \times 2^3 = 120$ kHz
 - $n = 4, 15 \times 2^4 = 240$ kHz
- In future n can take both positive and negative values
 - $n = -1, 15 \times 2^{-1} = 7.5$ kHz
 - $n = -2, 15 \times 2^{-2} = 3.75$ kHz → same as LTE NB-IoT subcarrier spacing

Thank You

To learn more, visit:

3G4G Website – <http://www.3g4g.co.uk/>

3G4G Blog – <http://blog.3g4g.co.uk/>

3G4G Small Cells Blog – <http://smallcells.3g4g.co.uk/>

Operator Watch - <http://operatorwatch.3g4g.co.uk/>

Follow us on Twitter: <https://twitter.com/3g4gUK>

Follow us on Facebook: <https://www.facebook.com/3g4gUK/>

Follow us on LinkedIn: <https://www.linkedin.com/company/3g4g>

Follow us on Slideshare: <https://www.slideshare.net/3G4GLtd>

Follow us on Youtube: <https://www.youtube.com/3G4G5G>

Follow us on Storify: <https://storify.com/3g4gUK>